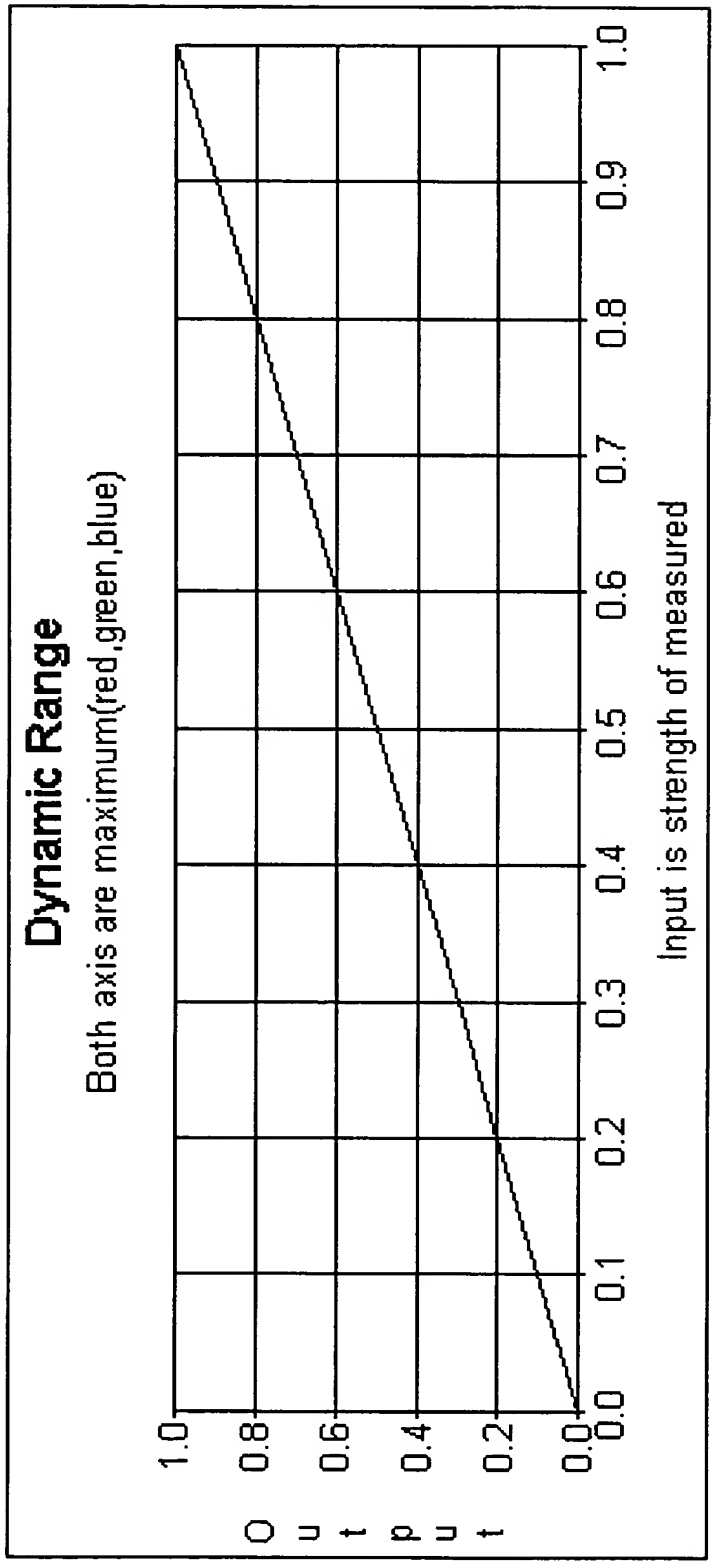
Fig. 1


Dynamic Range
Both axis are maximum(red,green,blue)
Output
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Input is strength of measured

```
pbox.Picture = LoadPicture(file_in)
    a rectangular picture of columns and rows is displayed
For icol = 1 To pbox.ScaleWidth
        loops through the columns of the image,
        For irow = 1 to pbox.ScaleHeight
                loops through the rows of the image
                color = pbox.Point(icol,irow)
                        the color of the point at current column, row.
                        blue = color / 65536
                                This sets blue to the most significant byte (division by 256 * 256)
                        color = color mod 65536
                                This keeps only the 2 least significant bytes (mod of 256 * 256)
                        green = color / 256
                                This sets green to the (next) most significant byte (division by 256)
                        red = color mod 256
                                This sets red to the least significant byte (modulus of 256)
                strength = red
                If strength < green Then strength = green
                If strength < blue Then strength = blue
                        the dot maximum is found
                corr = corra(strength)
                        Lookup correction for that value of dot maximum then correct RGB in the dot
                red = red * corr
                green = green * corr
                blue = blue * corr
                        Red, green, blue are now corrected to desired values
                pbox.PSet(icol,irow),RGB(red,green,blue)
                        Put the adjusted and corrected dot back into the image on the screen
        Next irow
                Get next row dot in the column
Next icol
        Get next image column of dots
```

Fig. 2

Fig. 3

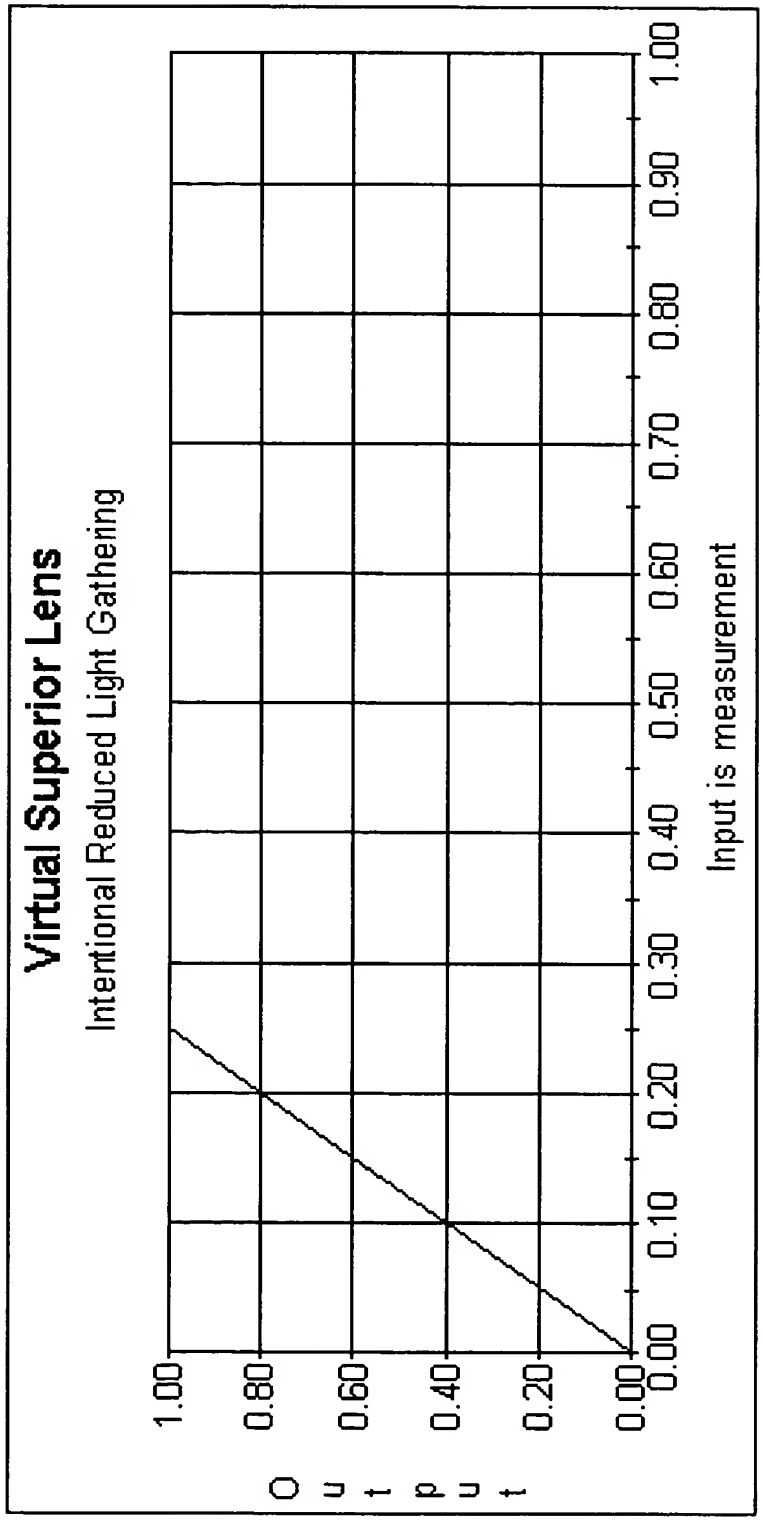

Virtual Superior Lens
Intentional Reduced Light Gathering
Output
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Input is measurement

Fig. 4

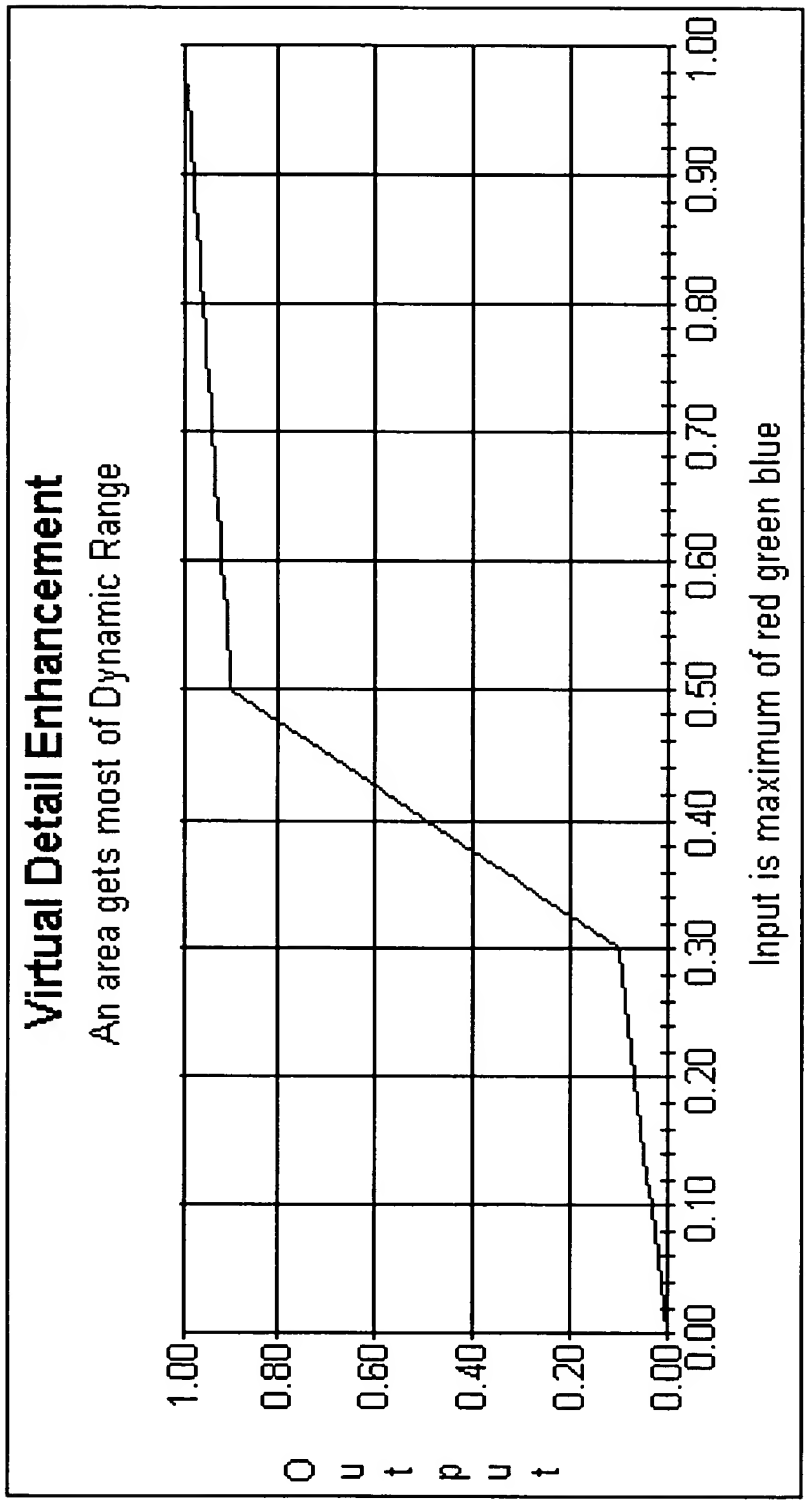

Virtual Detail Enhancement
An area gets most of Dynamic Range
Output
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Input is maximum of red green blue

Fig. 5

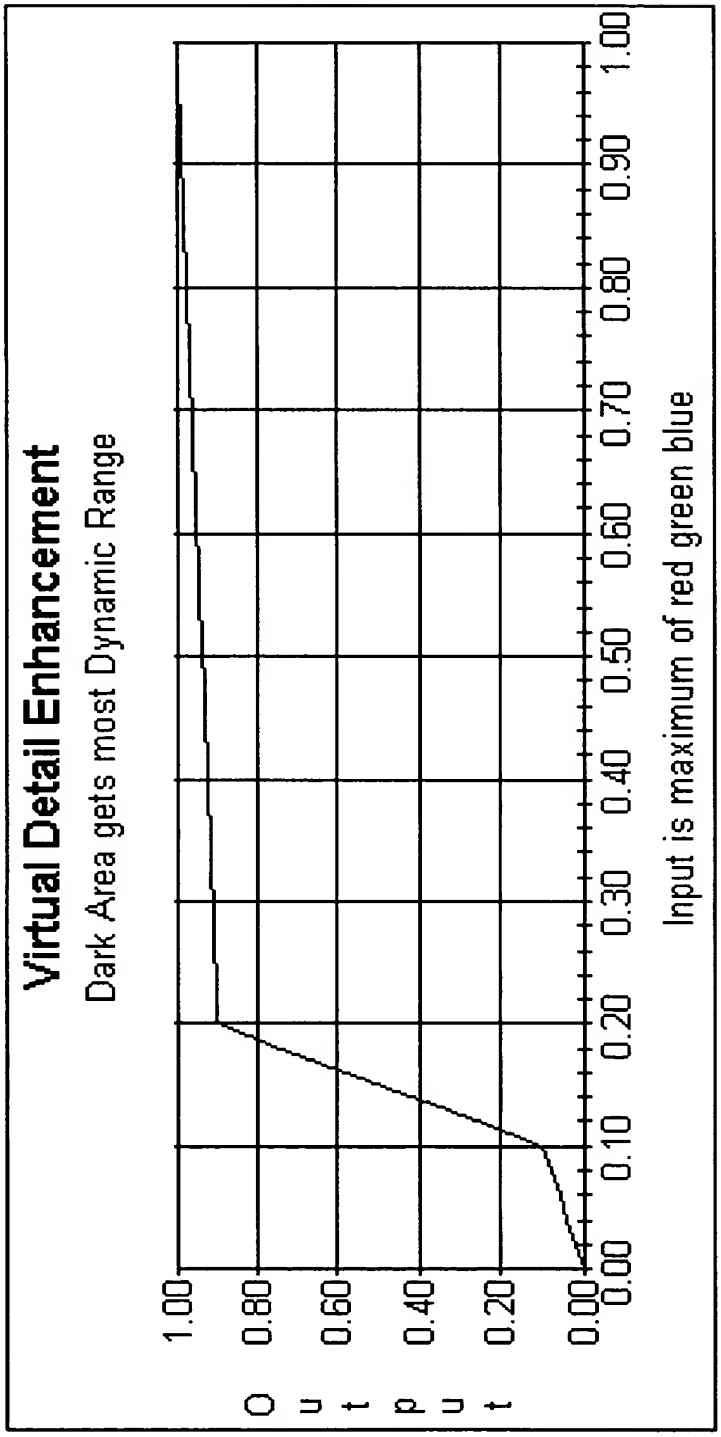
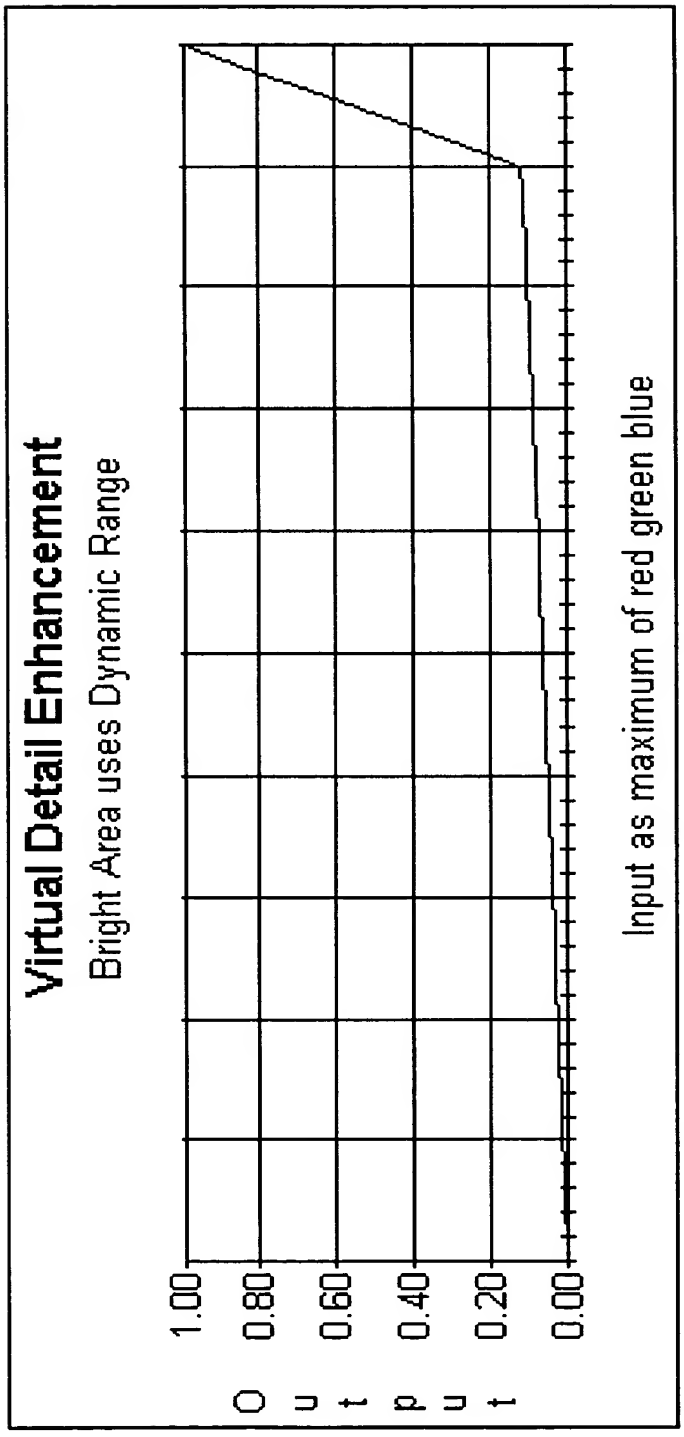

Virtual Detail Enhancement
Dark Area gets most Dynamic Range
Output
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Input is maximum of red green blue

Fig. 6


Virtual Detail Enhancement
Bright Area uses Dynamic Range
Output
1.00
0.80
0.60
0.40
0.20
0.00
Input as maximum of red green blue

Assuming the area was selected so that xdwn is less than xup

x1 = xdwn +1

x2 = xup -1

y1 = ydwn +1

y2 = yup -1

This Statement Ends the loop limit determination

For icol = x1 To x2

For irow = y1 to y2

The next 5 lines determine the color values (RGB)

color = pbox.Point(icol,irow)

blue = color / 65536

color = color mod 65536

green = color / 256

red = color mod 256

Find the dot Maximum

strength = red

If strength < green Then strength = green

If strength < blue Then strength = blue

The next line builds the histogram

hist(strength) = hist(strength) + 1

hist is an array (look up table) that stores the histogram counts

Next irow

Next icol

Find the minimum and maximum strengths, in some statistical sense, recorded stored in the histogram look up table (the array hist()).Creating a second look up table with the running totals of the histogram:

hsum(0) = hist(0)

hsum is the look up table used to hold the running total of the histogram

first (zeroth) running total is the first (zeroth) histogram element

For indx = 1 To drmx

indx is an index that runs from 1 (not 0) to the dynamic range maximum

hsum(indx) = hsum(indx - 1) + hist(indx)

the running total is calculated as previous running total plus next value

Next indx

Fig. 7a

Code for histogram look-up table

hsum(0) = hist(0)

hsum is the look up table used to hold the running total of the histogram

first (zeroth) running total is the first (zeroth) histogram element

For indx = 1 To drmx

Indx is an index that runs from 1 (not 0) to the dynamic range maximum

hsum(indx) = hsum(indx - 1) + hist(indx)

the running total is calculated as previous running total plus next value

Next indx

p002 = 0.02 * hsum(drmx) wherein

result is 2% of the total count and hsum(drmx) is the last running total (the total) of the histogram counts

p098 = 0.98 * hsum(drmx)

result is 98% of the total count, The next step is to find the index values corresponding to the 2% and 98% occurrence in the histogram.

i002 = -1; i098 = -1

these variables will hold the indices at the 2% and 98% level, for now they are set to -1

For indx = 0 to drmx

the loop runs over all the strength values

if hsum(indx) < p002 then i002 = indx

when the running total is less than 2% total then store it (stop storing it when it is over 2%)

if hsum(indx) < p098 then i098 = indx

when the running total is less than 98% total then store it (stop storing it when it is over 98%)

Next indx

Now, the histogram minimum and maximum values are set with a check to ensure that they are reasonable.

hmin = i002 + 1

hmin is set to 2% level strength index + 1 for reasons of symmetry

If hmin < 1 then hmin = 1

hmin is forced to be no less than 1

hmax = i098

hmax is set to 98% occurrence level of strength index

If hmax > drmx - 1 then hmax = drmx - 1

hmax is forced to be no more than dynamic range limit - 1 (254)

Fig. 7b

Fig. 8

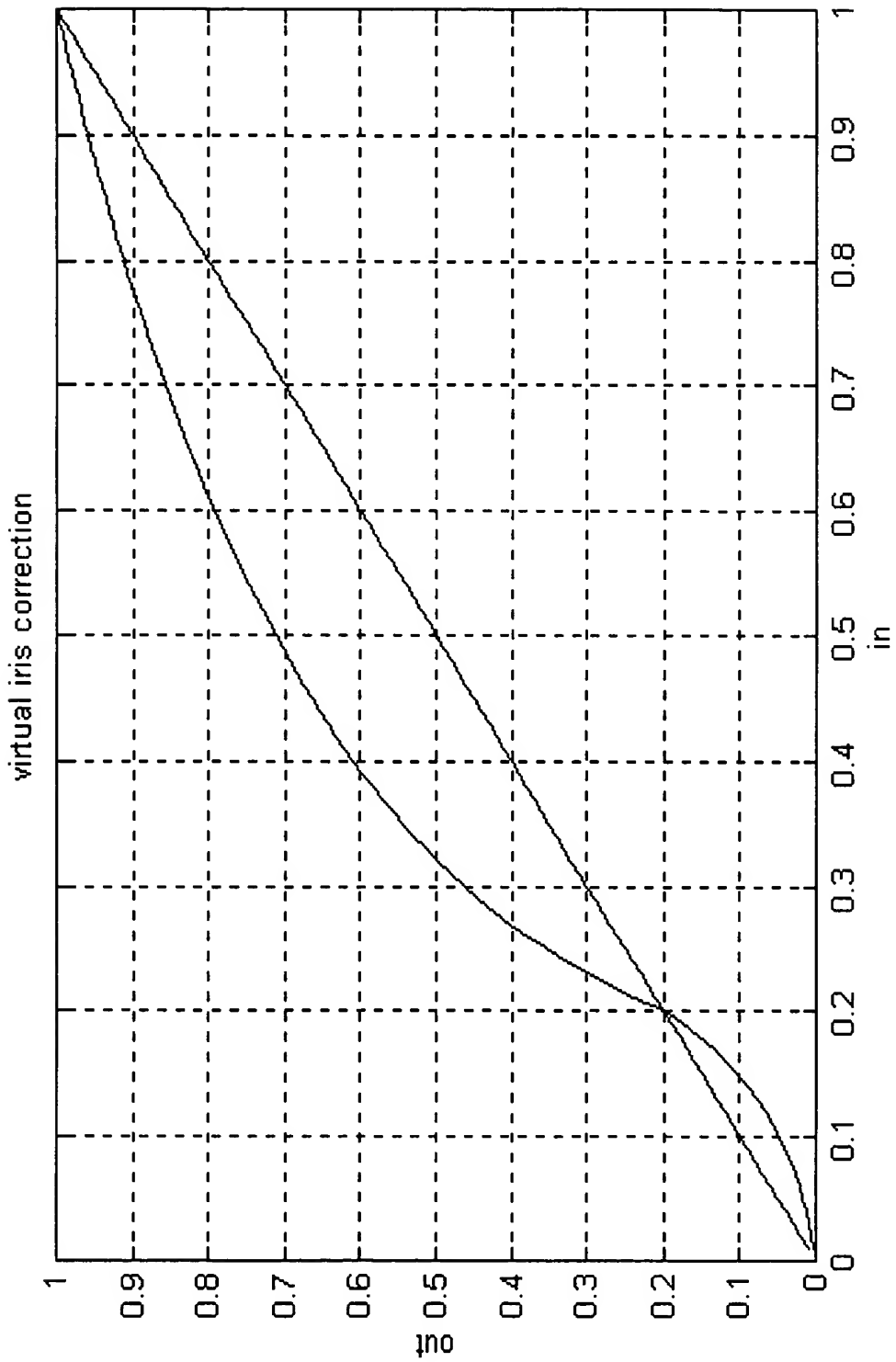


Fig. 9a

Input Image

Fig. 9b

PRIOR ART

Brightened

Fig. 9c

PRIOR ART

Bright 80%
Contrast

Fig. 9d

PRIOR ART

Bright 80%
Saturation

Fig. 9e

Virtual Flash

Output Image
Full Dyn Range

Fig. 9f

Virtual Flash

Output Image
Apply Fig. 8
curve

Fig. 10a

Input Image

Fig. 10b

PRIOR ART

Brightened

Fig. 10c

PRIOR ART

Bright 60%
Contrast

Fig. 10d

PRIOR ART

Bright 60%
Saturation 15%

Fig. 10e

Virtual Flash

Output
Image
Full Dyn
Range

Fig. 10f

Virtual Flash

Output Image
Apply Fig. 8
curve

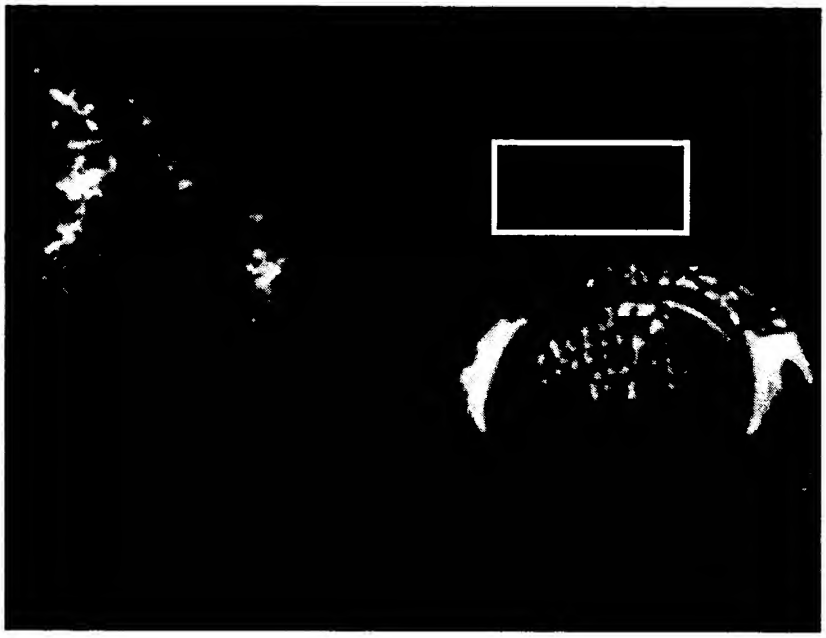


Fig. 11a

Input Image

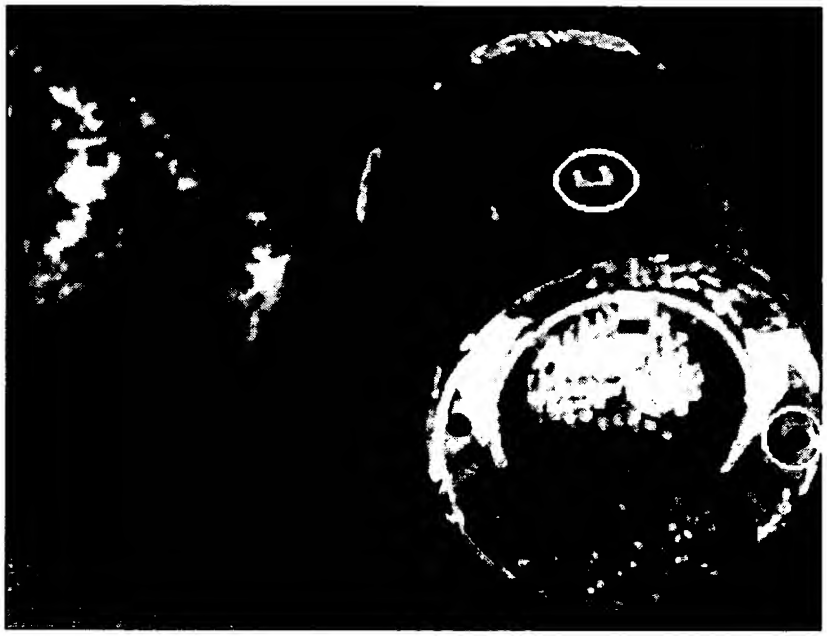


Fig. 11b

Forensic Flash

Output Image

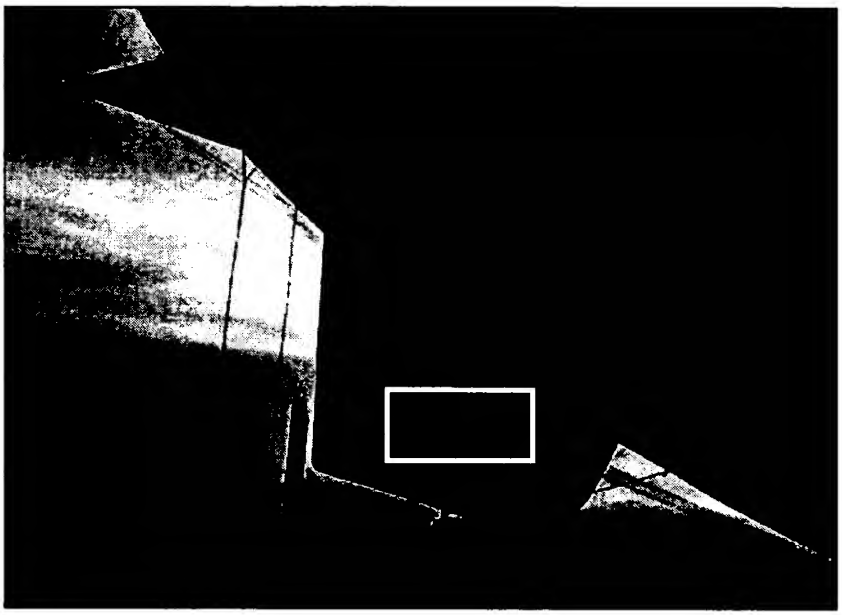


Fig. 12a

Input Image

Fig. 12b

Forensic Flash

Output Image

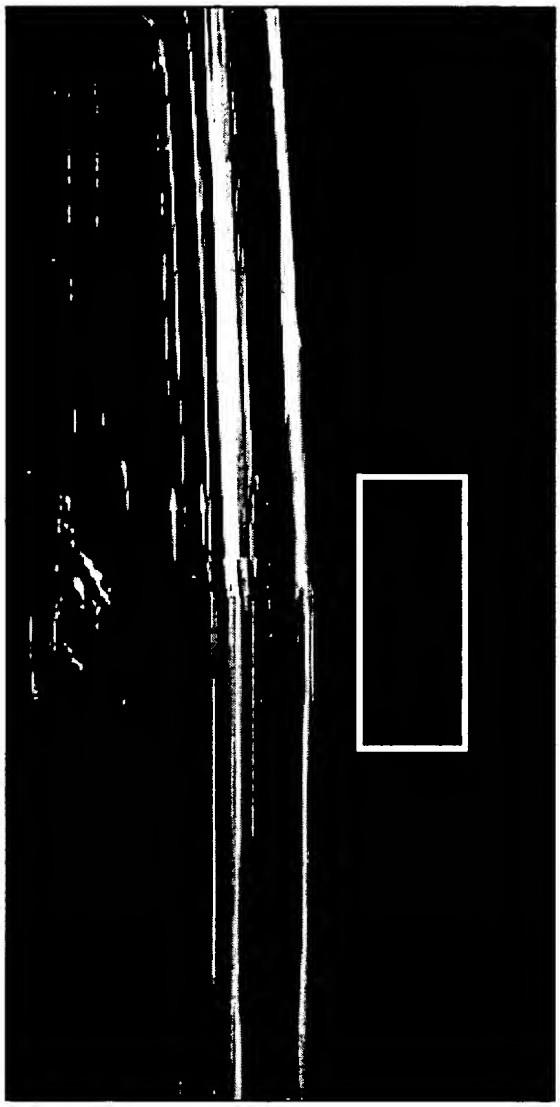


Fig. 13a

Input Image

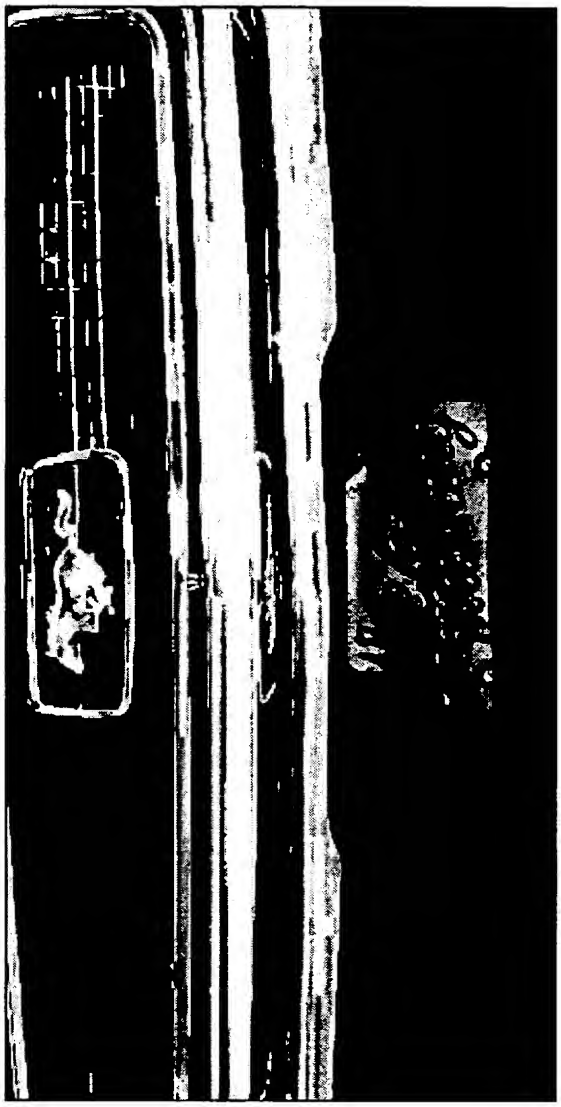


Fig. 13b

Forensic Flash

Output Image

Fig. 14a

Input Image

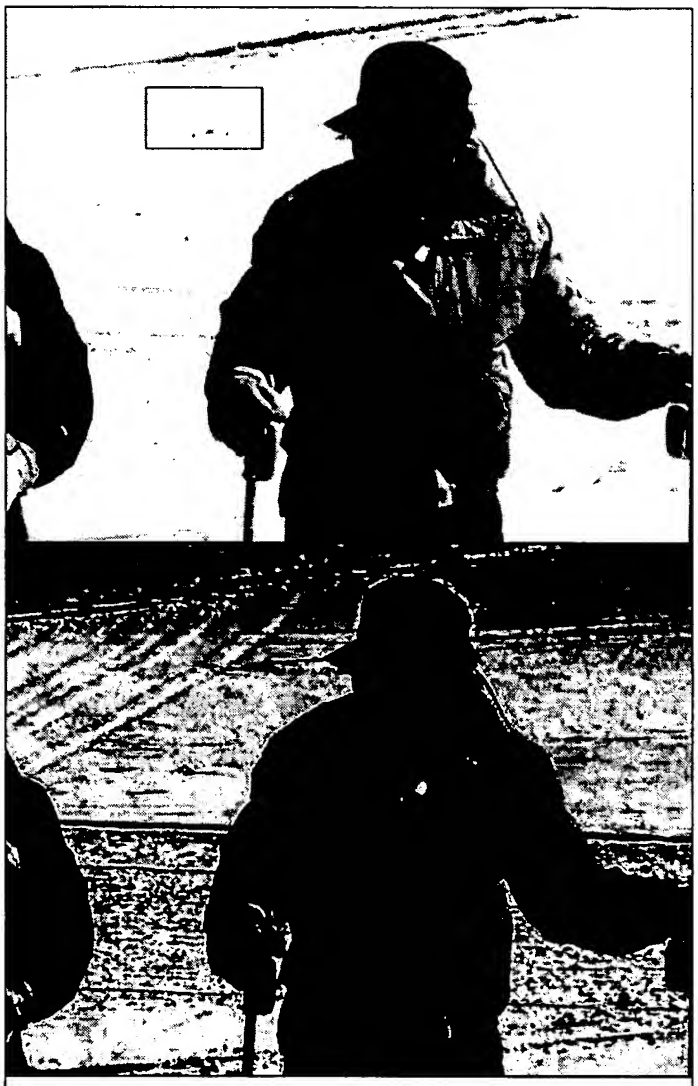


Fig. 14b

Forensic Flash

Output Image
Pick Snow

Fig. 14c

Forensic Flash

Output Image
Pick Face

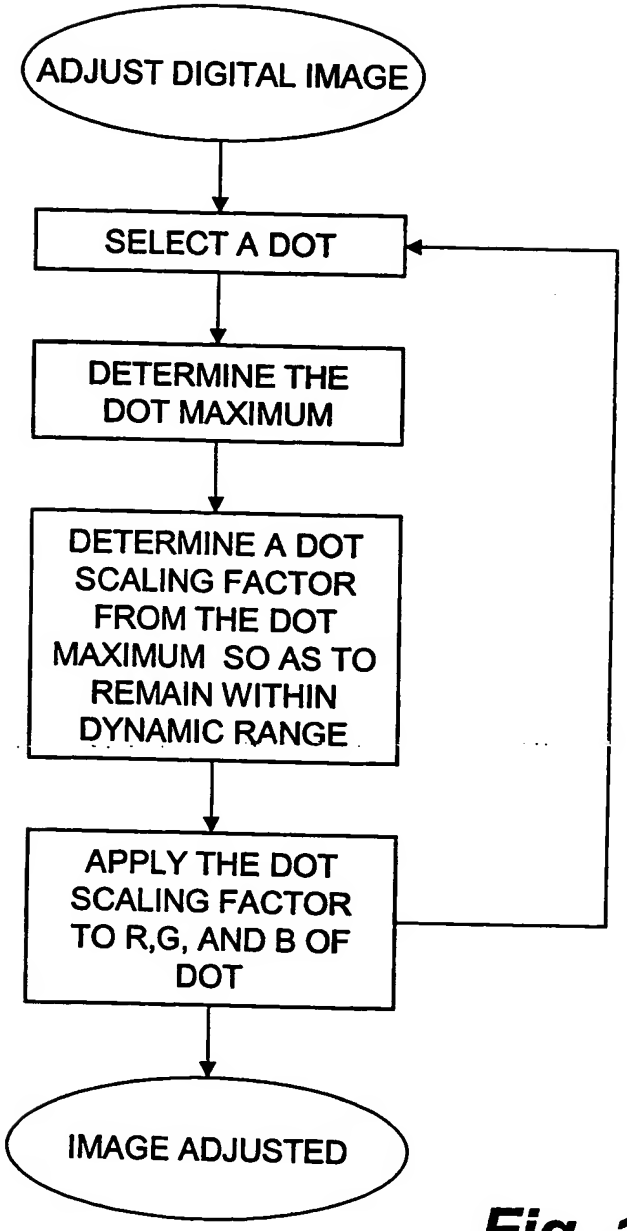

ADJUST DIGITAL IMAGE
SELECT A DOT
DETERMINE THE DOT MAXIMUM
DETERMINE A DOT SCALING FACTOR FROM THE DOT MAXIMUM SO AS TO REMAIN WITHIN DYNAMIC RANGE
APPLY THE DOT SCALING FACTOR TO R,G, AND B OF DOT
IMAGE ADJUSTED

Fig. 15a

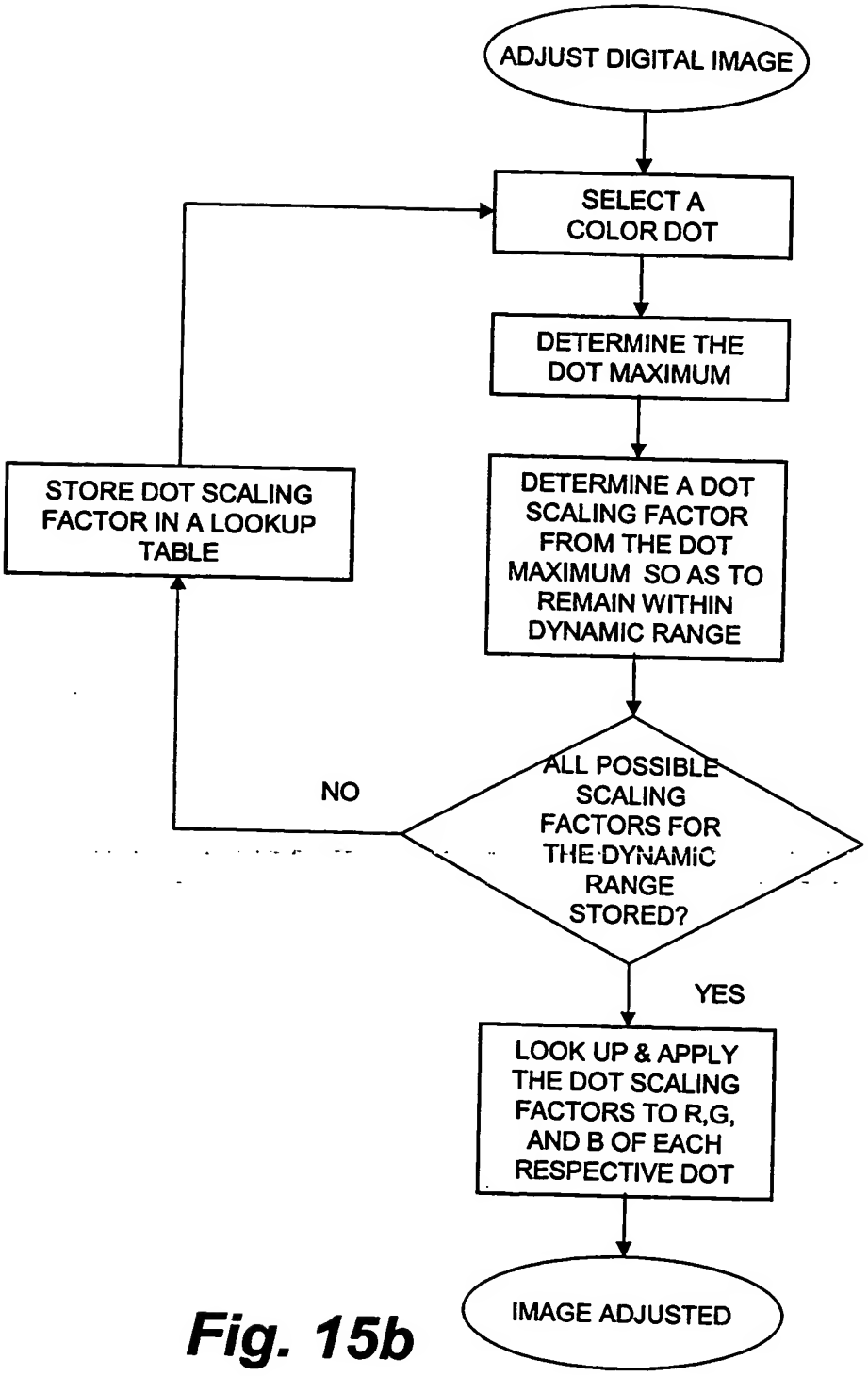

ADJUST DIGITAL IMAGE
SELECT A COLOR DOT
DETERMINE THE DOT MAXIMUM
DETERMINE A DOT SCALING FACTOR FROM THE DOT MAXIMUM SO AS TO REMAIN WITHIN DYNAMIC RANGE
ALL POSSIBLE SCALING FACTORS FOR THE DYNAMIC RANGE STORED?
NO
STORE DOT SCALING FACTOR IN A LOOKUP TABLE
YES
LOOK UP & APPLY THE DOT SCALING FACTORS TO R,G, AND B OF EACH RESPECTIVE DOT
IMAGE ADJUSTED

Fig. 15b

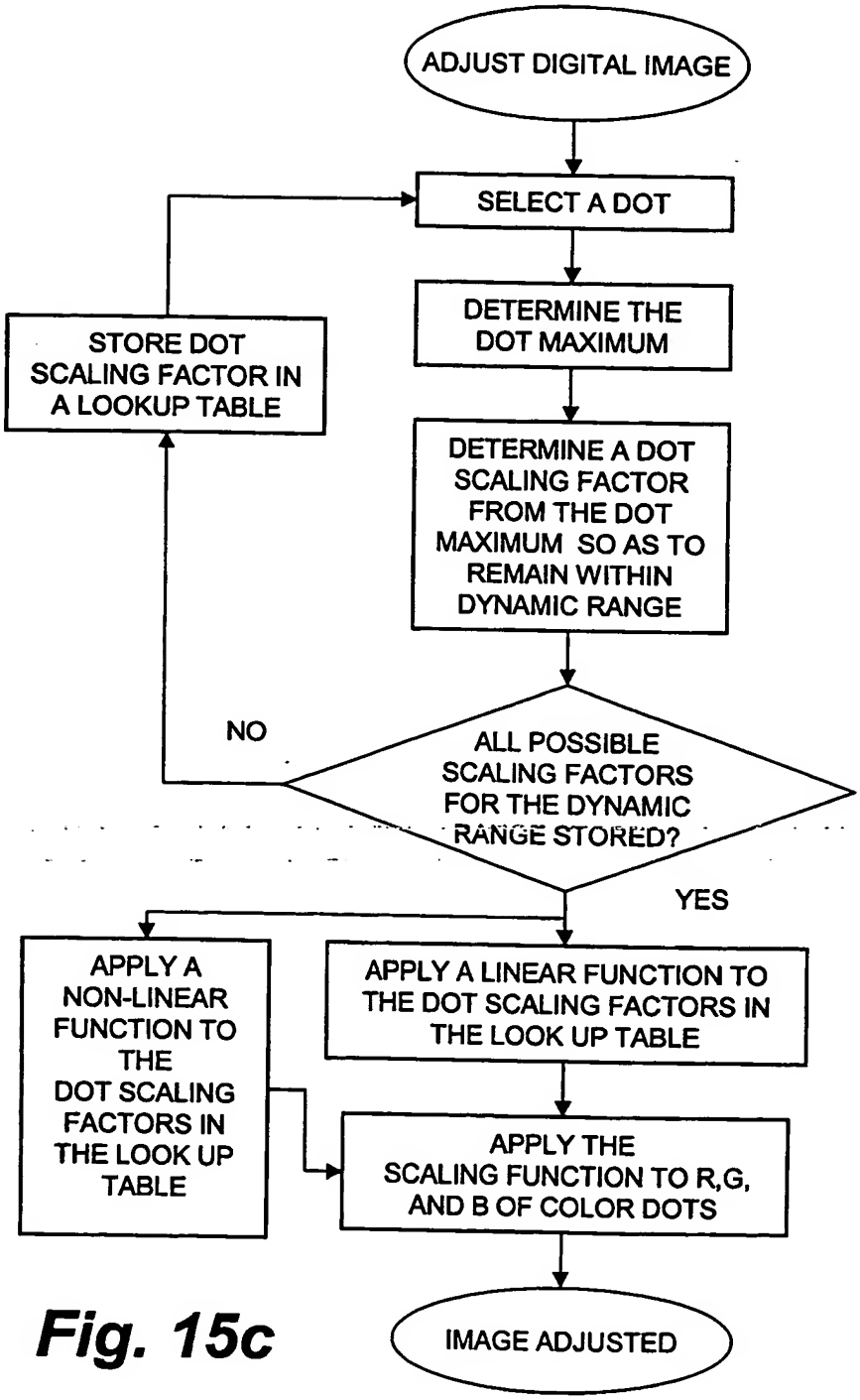

ADJUST DIGITAL IMAGE
SELECT A DOT
DETERMINE THE DOT MAXIMUM
DETERMINE A DOT SCALING FACTOR FROM THE DOT MAXIMUM SO AS TO REMAIN WITHIN DYNAMIC RANGE
ALL POSSIBLE SCALING FACTORS FOR THE DYNAMIC RANGE STORED?
NO
YES
STORE DOT SCALING FACTOR IN A LOOKUP TABLE
APPLY A NON-LINEAR FUNCTION TO THE DOT SCALING FACTORS IN THE LOOK UP TABLE
APPLY A LINEAR FUNCTION TO THE DOT SCALING FACTORS IN THE LOOK UP TABLE
APPLY THE SCALING FUNCTION TO R,G, AND B OF COLOR DOTS
IMAGE ADJUSTED

Fig. 15c

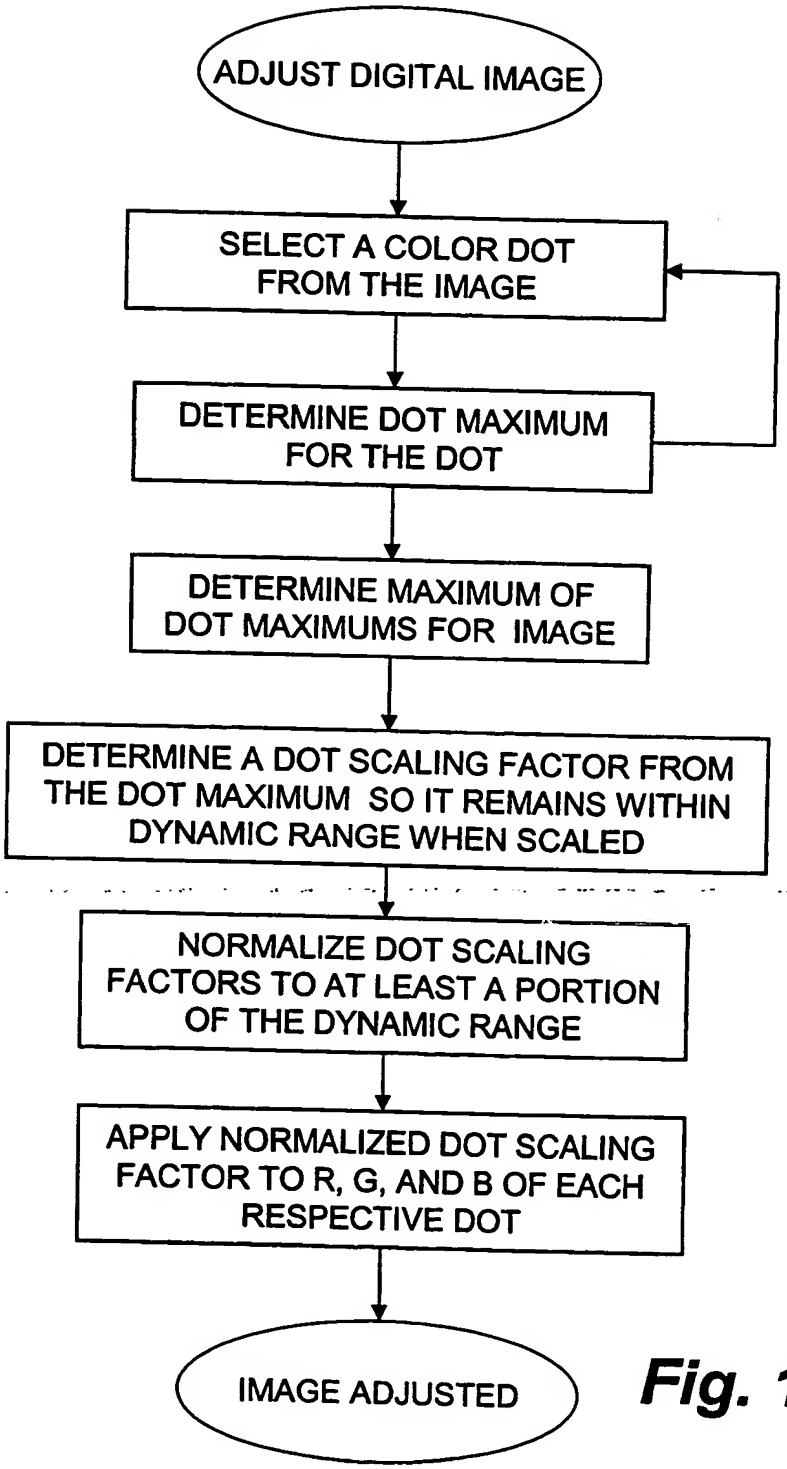

ADJUST DIGITAL IMAGE
SELECT A COLOR DOT FROM THE IMAGE
DETERMINE DOT MAXIMUM FOR THE DOT
DETERMINE MAXIMUM OF DOT MAXIMUMS FOR IMAGE
DETERMINE A DOT SCALING FACTOR FROM THE DOT MAXIMUM SO IT REMAINS WITHIN DYNAMIC RANGE WHEN SCALED
NORMALIZE DOT SCALING FACTORS TO AT LEAST A PORTION OF THE DYNAMIC RANGE
APPLY NORMALIZED DOT SCALING FACTOR TO R, G, AND B OF EACH RESPECTIVE DOT
IMAGE ADJUSTED

Fig. 16

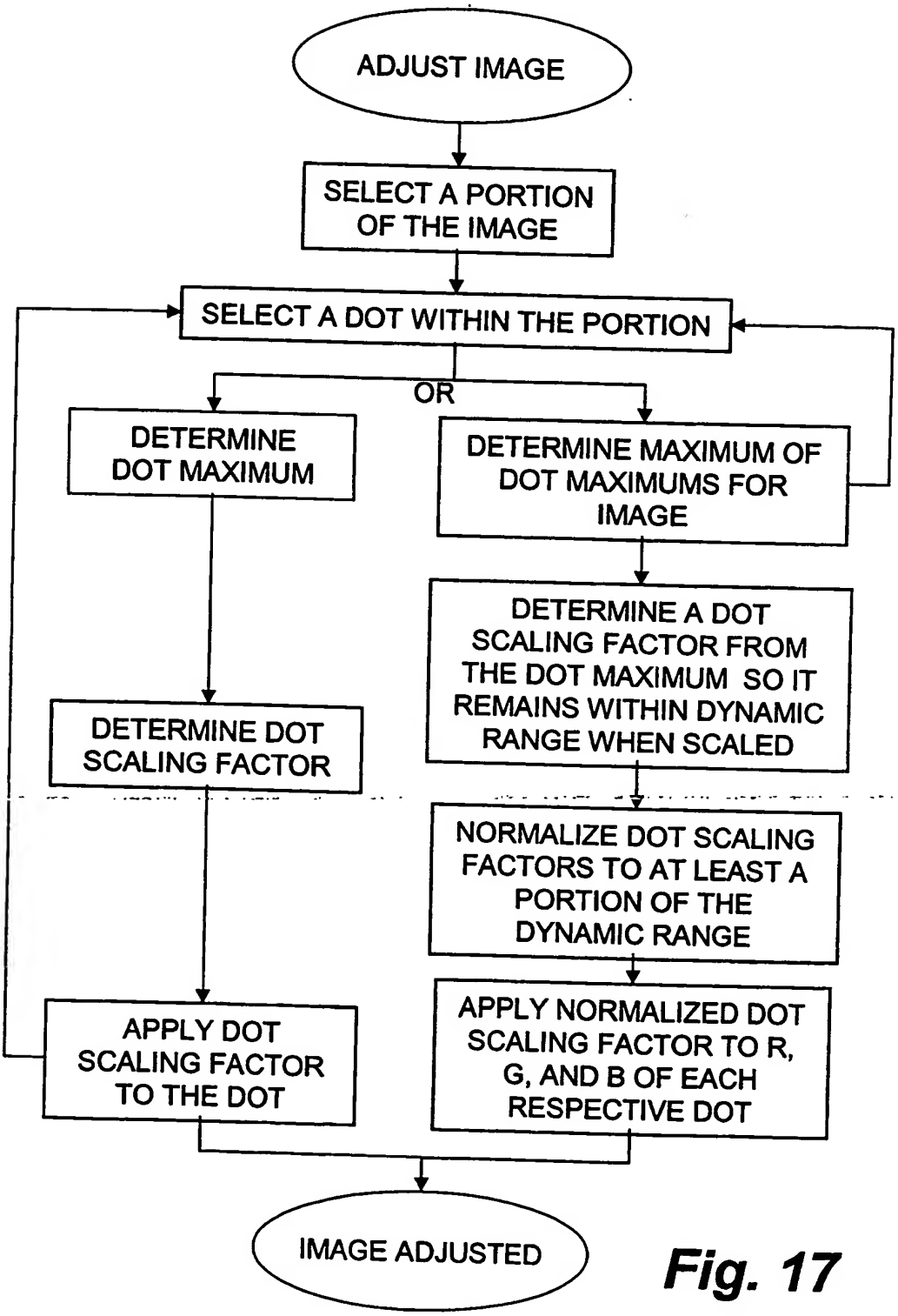

ADJUST IMAGE
SELECT A PORTION OF THE IMAGE
SELECT A DOT WITHIN THE PORTION
OR
DETERMINE DOT MAXIMUM
DETERMINE MAXIMUM OF DOT MAXIMUMS FOR IMAGE
DETERMINE A DOT SCALING FACTOR FROM THE DOT MAXIMUM SO IT REMAINS WITHIN DYNAMIC RANGE WHEN SCALED
DETERMINE DOT SCALING FACTOR
NORMALIZE DOT SCALING FACTORS TO AT LEAST A PORTION OF THE DYNAMIC RANGE
APPLY DOT SCALING FACTOR TO THE DOT
APPLY NORMALIZED DOT SCALING FACTOR TO R, G, AND B OF EACH RESPECTIVE DOT
IMAGE ADJUSTED

Fig. 17

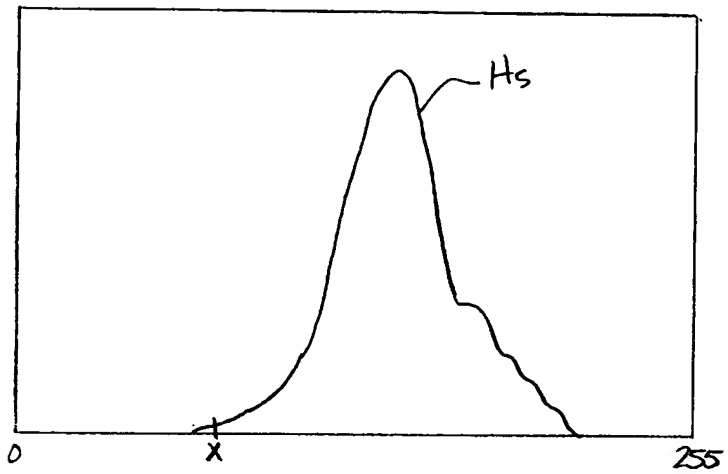


Fig. 18a

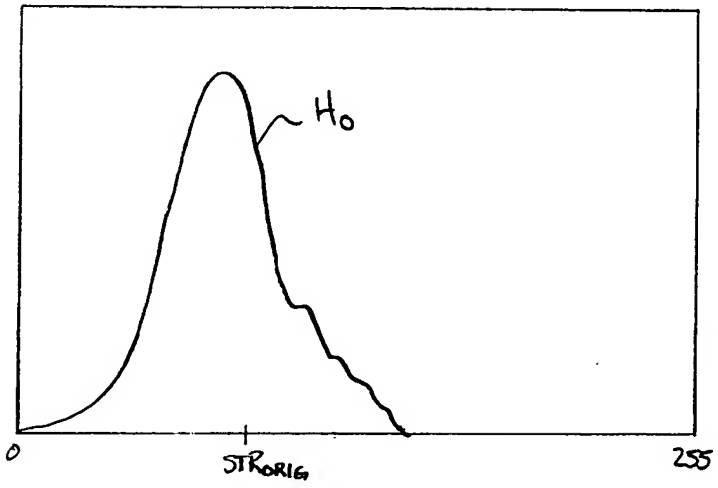


Fig. 18b

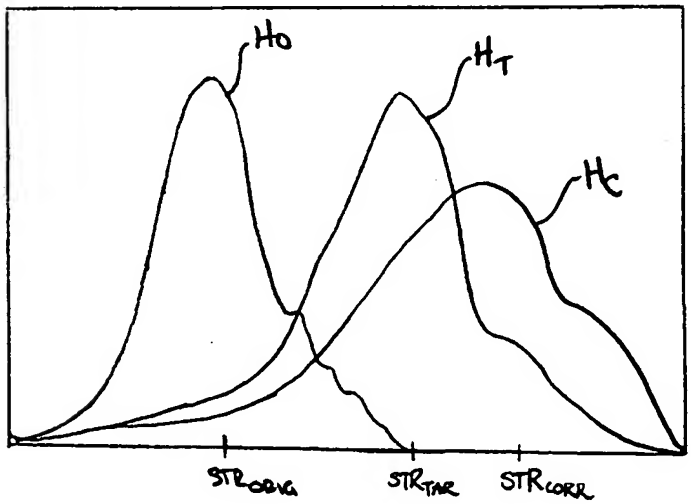
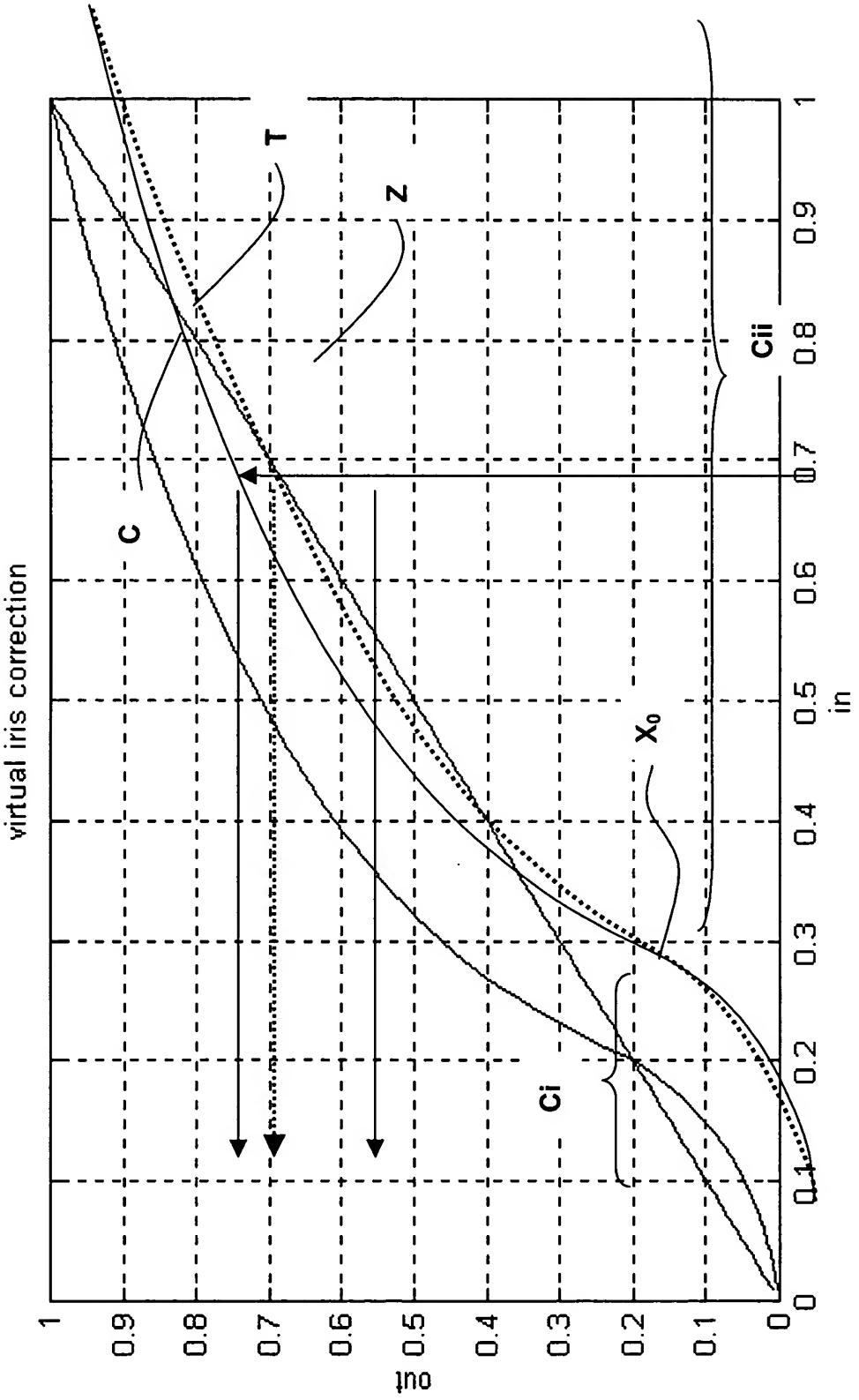


Fig. 20

Fig. 19


virtual iris correction
out
in
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
T
Z
C
Cii
Ci
X0